

## Appendix B - ATtiny25/45/85 Automotive Specification at 1.8V

This document contains information specific to devices operating at voltage between 1.8V and 3.6V. Only deviations with standard operating characteristics are covered in this appendix, all other information can be found in the complete Automotive datasheet. The complete ATtiny25/45/85 automotive datasheet can be found on [www.atmel.com](http://www.atmel.com)



**8-bit AVR<sup>®</sup>**  
**Microcontroller**  
**with 2/4/8K**  
**Bytes In-System**  
**Programmable**  
**Flash**

**ATtiny25**  
**ATtiny45**  
**ATtiny85**

**Appendix B**



## 1. Electrical Characteristics

### 1.1 Absolute Maximum Ratings

|                                                                                     |                        |
|-------------------------------------------------------------------------------------|------------------------|
| Operating Temperature .....                                                         | –55°C to +150°C        |
| Storage Temperature .....                                                           | –65°C to +175°C        |
| Voltage on any Pin except $\overline{\text{RESET}}$<br>with respect to Ground ..... | –0.5V to $V_{CC}+0.5V$ |
| Voltage on $\overline{\text{RESET}}$ with respect to Ground.....                    | –0.5V to +13.0V        |
| Maximum Operating Voltage .....                                                     | 6.0V                   |
| DC Current per I/O Pin .....                                                        | 30.0 mA                |
| DC Current $V_{CC}$ and GND Pins.....                                               | 200.0 mA               |

Note: Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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### 1.2 DC Characteristics

$T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{CC} = 1.8V$  to  $3.6V$  (unless otherwise noted)

| Symbol    | Parameter                                                           | Condition                                    | Min.              | Typ. | Max.              | Units         |
|-----------|---------------------------------------------------------------------|----------------------------------------------|-------------------|------|-------------------|---------------|
| $V_{IL}$  | Input Low Voltage, except XTAL1 and $\overline{\text{RESET}}$ pin   | $V_{CC} = 1.8V - 3.6V$                       | –0.5              |      | $0.2V_{CC}^{(1)}$ | V             |
| $V_{IH}$  | Input High Voltage, except XTAL1 and $\overline{\text{RESET}}$ pins | $V_{CC} = 1.8V - 3.6V$                       | $0.7V_{CC}^{(2)}$ |      | $V_{CC} + 0.5$    | V             |
| $V_{IL1}$ | Input Low Voltage, XTAL1 pin                                        | $V_{CC} = 1.8V - 3.6V$                       | –0.5              |      | $0.1V_{CC}^{(1)}$ | V             |
| $V_{IH1}$ | Input High Voltage, XTAL1 pin                                       | $V_{CC} = 1.8V - 3.6V$                       | $0.9V_{CC}^{(2)}$ |      | $V_{CC} + 0.5$    | V             |
| $V_{IL2}$ | Input Low Voltage, $\overline{\text{RESET}}$ pin                    | $V_{CC} = 1.8V - 3.6V$                       | –0.5              |      | $0.2V_{CC}^{(1)}$ | V             |
| $V_{IH2}$ | Input High Voltage, $\overline{\text{RESET}}$ pin                   | $V_{CC} = 1.8V - 3.6V$                       | $0.9V_{CC}^{(2)}$ |      | $V_{CC} + 0.5$    | V             |
| $V_{IL3}$ | Input Low Voltage, $\overline{\text{RESET}}$ pin as I/O             | $V_{CC} = 1.8V - 3.6V$                       | –0.5              |      | $0.3V_{CC}^{(1)}$ | V             |
| $V_{IH3}$ | Input High Voltage, $\overline{\text{RESET}}$ pin as I/O            | $V_{CC} = 1.8V - 3.6V$                       | $0.6V_{CC}^{(2)}$ |      | $V_{CC} + 0.5$    | V             |
| $V_{OL}$  | Output Low Voltage <sup>(3)</sup> , I/O pin except RESET            | $I_{OL} = 0.5 \text{ mA}$ , $V_{CC} = 1.8V$  |                   |      | 0.4               | V             |
| $V_{OH}$  | Output High Voltage <sup>(4)</sup> , I/O pin except RESET           | $I_{OH} = -0.5 \text{ mA}$ , $V_{CC} = 1.8V$ | 1.2               |      |                   | V             |
| $I_{IL}$  | Input Leakage Current I/O Pin                                       | $V_{CC} = 3.6V$ , pin low (absolute value)   |                   |      | 1                 | $\mu\text{A}$ |
| $I_{IH}$  | Input Leakage Current I/O Pin                                       | $V_{CC} = 3.6V$ , pin high (absolute value)  |                   |      | 1                 | $\mu\text{A}$ |
| $R_{RST}$ | Reset Pull-up Resistor                                              |                                              | 30                |      | 60                | $k\Omega$     |
| $R_{PU}$  | I/O Pin Pull-up Resistor                                            |                                              | 20                |      | 50                | $k\Omega$     |

## 1.2 DC Characteristics (Continued)

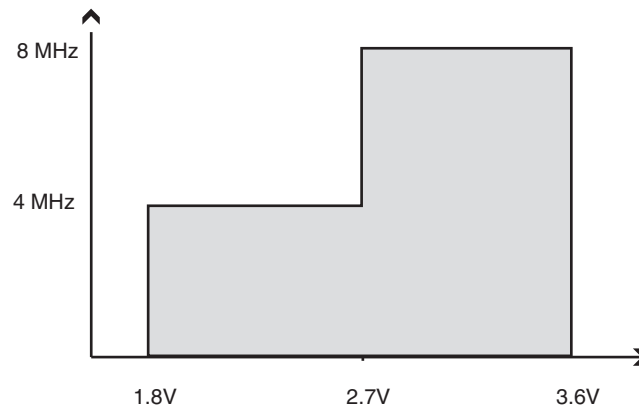
$T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 1.8\text{V}$  to  $3.6\text{V}$  (unless otherwise noted)

| Symbol     | Parameter                               | Condition                                                                   | Min. | Typ.     | Max.     | Units         |
|------------|-----------------------------------------|-----------------------------------------------------------------------------|------|----------|----------|---------------|
| $I_{CC}$   | Power Supply Current                    | Active 4 MHz, $V_{CC} = 1.8\text{V}$                                        |      | 0.8      | 1        | mA            |
|            |                                         | Idle 4 MHz, $V_{CC} = 1.8\text{V}$                                          |      | 0.2      | 0.3      | mA            |
|            | Power-down mode                         | WDT disabled, $V_{CC} = 1.8\text{V}$<br>WDT enabled, $V_{CC} = 1.8\text{V}$ |      | 0.2<br>4 | 10<br>20 | $\mu\text{A}$ |
| $V_{ACIO}$ | Analog Comparator Input Offset Voltage  | $V_{CC} = 2.7\text{V}$<br>$V_{in} = V_{CC}/2$                               |      | <10      | 40       | mV            |
| $I_{ACLK}$ | Analog Comparator Input Leakage Current | $V_{CC} = 2.7\text{V}$<br>$V_{in} = V_{CC}/2$                               | -50  |          | 50       | nA            |
| $t_{ACPD}$ | Analog Comparator Propagation Delay     | $V_{CC} = 2.7\text{V}$                                                      |      | 500      |          | ns            |

## 1.3 Maximum Speed vs. $V_{CC}$

Maximum frequency is dependent on  $V_{CC}$ . As shown in [Figure 1-1](#), the Maximum Frequency vs.  $V_{CC}$  curve is linear between  $1.8\text{V} < V_{CC} < 3.6\text{V}$ .

**Figure 1-1.** Maximum Frequency versus  $V_{CC}$



## 1.4 ADC Characteristics

$T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 1.8\text{V}$  to  $3.6\text{V}$  (unless otherwise noted)

| Symbol    | Parameter                                                                                  | Condition                                                                                         | Min            | Typ  | Max                     | Units         |
|-----------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------|------|-------------------------|---------------|
|           | Resolution                                                                                 |                                                                                                   |                | 8    |                         | Bits          |
|           | Absolute accuracy<br>(Including INL, DNL,<br>quantization error, gain<br>and offset error) | $V_{REF} = 2.7\text{V}$ , $V_{CC} = 2.7\text{V}$ ,<br>ADC clock = 200 kHz                         |                | 2    | 3.5                     | LSB           |
|           |                                                                                            | $V_{REF} = 2.7\text{V}$ , $V_{CC} = 2.7\text{V}$ ,<br>ADC clock = 200 kHz<br>Noise Reduction Mode |                | 2    | 3.5                     | LSB           |
|           | Integral Non-Linearity<br>(INL)                                                            | $V_{REF} = 2.7\text{V}$ , $V_{CC} = 2.7\text{V}$ ,<br>ADC clock = 200 kHz                         |                | 0.6  | 2.5                     | LSB           |
|           | Differential Non-Linearity<br>(DNL)                                                        | $V_{REF} = 2.7\text{V}$ , $V_{CC} = 2.7\text{V}$ ,<br>ADC clock = 200 kHz                         |                | 0.30 | 1.0                     | LSB           |
|           | Gain Error                                                                                 | $V_{REF} = 2.7\text{V}$ , $V_{CC} = 2.7\text{V}$ ,<br>ADC clock = 200 kHz                         | -3.5           | -1.3 | +3.5                    | LSB           |
|           | Offset Error                                                                               | $V_{REF} = 2.7\text{V}$ , $V_{CC} = 2.7\text{V}$ ,<br>ADC clock = 200 kHz                         |                | 1.8  | 3.5                     | LSB           |
|           | Conversion Time                                                                            | Free Running<br>Conversion                                                                        | 13 cycles      |      |                         | $\mu\text{s}$ |
|           | Clock Frequency                                                                            |                                                                                                   | 50             |      | 200                     | kHz           |
| $AV_{CC}$ | Analog Supply Voltage                                                                      |                                                                                                   | $V_{CC} - 0.3$ |      | $V_{CC} + 0.3$          | V             |
| $V_{REF}$ | Reference Voltage                                                                          |                                                                                                   | 1.0            |      | $AV_{CC}$               | V             |
| $V_{IN}$  | Input Voltage                                                                              |                                                                                                   | GND            |      | $V_{REF} - 50\text{mV}$ | V             |
|           | Input Bandwidth                                                                            |                                                                                                   |                | 38.5 |                         | kHz           |
| $V_{INT}$ | Internal Voltage Reference                                                                 |                                                                                                   | 1.0            | 1.1  | 1.2                     | V             |
| $R_{REF}$ | Reference Input<br>Resistance                                                              |                                                                                                   | 25.6           | 32   | 38.4                    | k $\Omega$    |
| $R_{AIN}$ | Analog Input Resistance                                                                    |                                                                                                   |                | 100  |                         | M $\Omega$    |

- Notes:
1. "Max" means the highest value where the pin is guaranteed to be read as low
  2. "Min" means the lowest value where the pin is guaranteed to be read as high
  3. Although each I/O port can sink more than the test conditions (0.5 mA at  $V_{CC} = 1.8\text{V}$ ) under steady state conditions (non-transient), the following must be observed:
    - 1] The sum of all IOL, for ports B0 - B5, should not exceed 50 mA.
 If IOL exceeds the test condition, VOL may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test condition.
  4. Although each I/O port can source more than the test conditions (0.5 mA at  $V_{CC} = 1.8\text{V}$ ) under steady state conditions (non-transient), the following must be observed:
    - 1] The sum of all IOH, for ports B0 - B5 should not exceed 50 mA.
 If IOH exceeds the test condition, VOH may exceed the related specification. Pins are not guaranteed to source current greater than the listed test condition.

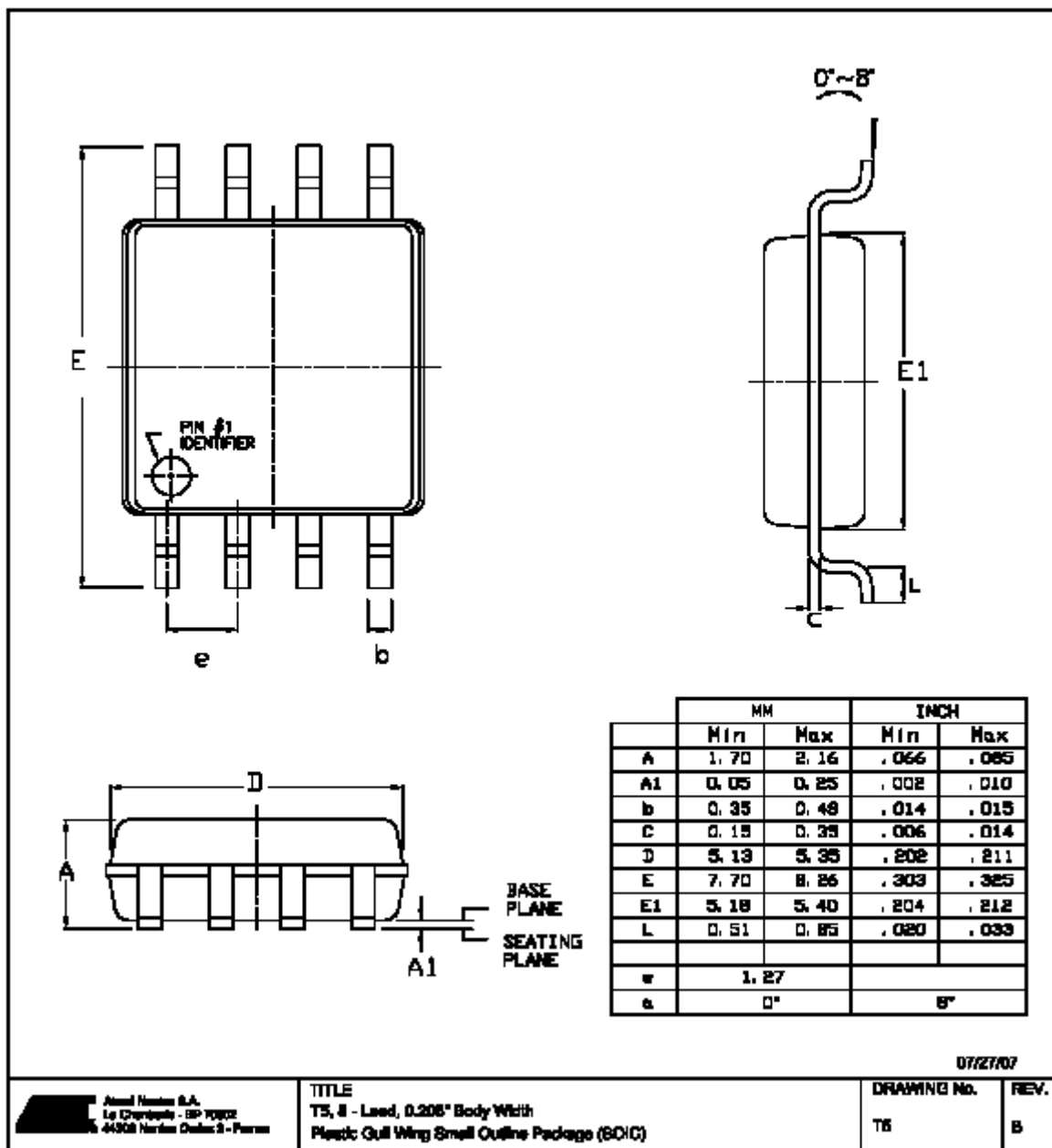
## 2. Ordering Information

| Power Supply | Speed (MHz) | ISP Flash | Ordering Code  | Package | Operation Range             |
|--------------|-------------|-----------|----------------|---------|-----------------------------|
| 1.8 - 3.6V   | 4-8         | 2 KB      | ATtiny25V-15ST | T5      | Automotive (−40°C to +85°C) |
| 1.8 - 3.6V   | 4-8         | 4 KB      | ATtiny45V-15ST | T5      | Automotive (−40°C to +85°C) |
| 1.8 - 3.6V   | 4-8         | 8 KB      | ATtiny85V-15ST | T5      | Automotive (−40°C to +85°C) |

## 2.1 Package Information

| Package Type |                                                                  |
|--------------|------------------------------------------------------------------|
| T5           | 8-lead, 0.208" Wide, Plastic Gull-Wing Small Outline (EIAJ SOIC) |

## 2.2 T5





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